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COMPARISON OF CENSUS METHODS FOR PHEASANTS IN NEBRASKA

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In plans for the Nebraska Upland Game Bird Pittman Robinson Project the censusing of pheasants and tabulation of population densities was of prime importance. A summary of the data at hand and a comparison of the various methods tried will be discussed here.

Roadside Count

Because of the success in other states, the roadside count was tried in Nebraska. Counts were made at weekly intervals throughout the autumn and winter of 1941–43 on two 15-mile routes through Valley County in central Nebraska (Table 1). The results, however, are more confusing than enlightening. The variation in numbers of birds seen from week to week was nearly as great as that between years, the maximum within one year being 1,440 per cent, and that between separate years 4,500

TABLE 1.—COMPARISON OF AUTUMN AND WINTER ROADSIDE COUNTS OF PHEASANTS IN VALLEY COUNTY, NEBRASKA. AVERAGE BIRDS PER MILE. ITALICIZED FIGURES ARE OF COUNTS DURING HUNTING SEASONS,

Date		*1941*	*1942*	*1943*	*Averages*
July	15–21			3.25	3.25
	22–31			1.1	1.1
August	1– 7	.66			.66
	8–14	2.3	1.6	2.45	2.15
	15–21	.36	3.1	2.91	2.12
	22–31	.63	2.05	2.45	1.71
September	1– 7	1.43		.56	1.00
	8–14	.33	3.5	2.4	2.11
	15–21		2.7	2.25	2.47
	22–30	.36	3.85	3.65	2.62
October	1– 7	.66	3.45	3.95	2.69
	8–14	1.2	5.1	2.6	2.96
	15–21	*1.0*	1.0	*1.85*	*1.28*
	22–31	*.29*	*3.6*	*1.55*	*1.81*
November	1– 7	*.16*	*1.2*	*7.2*	*2.85*
	8–14		*3.85*	*5.5*	*4.68*
	15–21	.46	2.3	*2.6*	*1.79*
	22–30		*1.3*	*2.15*	*1.72*
December	1– 7		8.15	*2.1*	*5.17*
	8–14				
	15–21			*1.75*	*1.75*
Total miles		360	585	630	1,575
Total birds		279	1,814	1,678	3,771
Average birds per mile		0.79	3.07	2.66	2.17
Percentage variation		*1,440*	*815*	*1.300*	*783*

per cent. Such tremendous variations nullify any attempt at accurate prediction of the numbers present by use of this method over a short period. In Table 1 italicized figures are of counts during the hunting season. Roadside hunting, a common practice, would be expected to affect greatly the numbers of birds seen along a highway, as pheasants learn rapidly to avoid the presence of automobiles. In 1941, the average number seen per mile previous to the hunting season was 0.88 and during the hunting season was 0.48, a reduction of 45 per cent. In 1942, the comparable figures were 2.92 and 2.49, a reduction of 14 per cent. These data would suggest that roadside counts could best be used prior to hunting. In 1943, however, the data were contradictory, the preseason counts averaged 2.5 and those during the season 3.1 per mile, an increase of 24 per cent.

Among the factors to consider, is that of the time and number of the preseason counts. In 1941 the census made eight weeks before the season was compared with three during the season, which was short. In 1942 there were eight before and five during the hunting season; and in 1943 there were 11 preseason tallies and eight during the long season. This is further substantiation that the roadside count is of value only as when used for several weeks prior to hunting.

It is not yet feasible to predict the presence or absence of pheasants along a census route by weather and temperature observations made before taking a count. Errors from the physiological condition of the birds, the presence or absence of vehicles on the road in advance of the observer, the effect of previous weather, and the very nature of the birds themselves obliterate any

consistency in data gathered by roadside counts. On the two roadside census routes in Valley County, a total of 1,575 miles were covered, 3,771 pheasants counted, and the weather data recorded, but still there was no indication as to how many birds would be seen during a roadside count on any given morning.

DETONATION COUNTS VS. ONE-MINUTE COUNTS

These two methods have already been discussed (McClure, H. E., Journ. Wildl. Mgt. 8: 61–65, 1944) and have been further refined through another year of observations. The first involves explosion of small aerial salutes and counting the number of pheasant roosters which respond. An area is censused by shooting these bombs at 5-mile intervals. The one-minute count is simply to stop the automobile and listen for the pheasants crowing during a one-minute period. An area may be censused at any interval desired, such as two, three or five miles. Both methods are most productive when used from 6 to 8 A.M. The one-minute count seems three times as successful as the aerial salute from 6 to 7 A.M., and more successful between 7 and 8 A.M. The two methods give closely similar results, however, from 8 to 9 A.M. (Table 2).

TABLE 2.—COMPARISON OF RESULTS IN CENSUSING PHEASANTS BY DETONATIONS AND ONE-MINUTE COUNTS, NEBRASKA, 1941–43

	Number of shots	*Average calls per shot*	*Number of 1-minute counts*	*Average calls per minute*
TIME OF DAY				
6– 7 A. M.	51	9.2	64	32.2
7– 8	151	8.3	252	11.1
8– 9	56	8.6	87	9.1
9–10	32	7.0		
6– 7 P. M.	2	16.0	7	3.5
7– 8	13	3.7	17	1.5
8– 9	9	5.7	4	2.0
TEMPERATURE °F.				
0– 10	8	20.8	4	21.5
11– 20	13	5.0		
21– 30	36	15.5	21	13.3
31– 40	65	15.8	72	17.5
41– 50	39	11.2	87	20.0
51– 60	50	8.3	124	12.6
61– 70	88	5.0	180	5.1
71– 80	31	2.3	28	2.8
81– 90	4	3.0	21	1.2
91–100	2	2.0	9	1.7
HUMIDITY RELATIVE (*per cent*)				
0– 10				
11– 20				
21– 30	1	2.0	18	1.0
31– 40				
41– 50	5	3.0	13	1.3
51– 60	8	8.6	45	8.1
61– 70	27	7.2	16	12.0
71– 80	55	9.1	89	8.0
81– 90	132	8.1	247	12.2
91–100	53	9.5	88	12.7

The responses to explosions and normal spontaneous crowing did not differ as markedly at various temperatures as at different times of day. In general, about the same number responded to a bomb as would call in one minute at most temperatures from 0° to 100°F., but spontaneous crowing was consistently high between 20° and 60°F. (Table 3). Likewise there was close similarity between the response to explosions and the normal number of calls in one minute in respect to relative humidity, but there was no great variation in crowing activity at humidities above 50 per cent.

Results of the three methods of pheasant enumeration (detonations, one-minute counts, and roadside counts) for each month are compared in Table 3. The detonation method can be used throughout the year with some success but seems best for indicating relative numbers during February and March. Pheasants do not regularly begin spontaneous crowing until March and cease by late July. Intermittent crowing may be heard in any month, but one-minute counts seem most efficacious during the courting months, April and May, when the relative numbers of breeding cocks are indicated. Roadside counts are best used in the autumn as an indication of the post-breeding population.

The detonation and roadside-count methods can be compared for the last six months of the year in Table 3. The average number of cocks responding to an explosion usually is double the number seen per mile of driving. An average of twice as many birds were heard at each shot as were seen along each mile. Both of the methods must be correlated with the known number of birds in a given area of land. This number probably can be determined only by use of many men to drive out the birds. The variation in number of birds seen and heard was about equal.

TABLE 3.—COMPARISON OF CENSUS METHODS FOR PHEASANTS.

	Detonations		*One-minute crowing count*		*Roadside count*	
	Number of shots	*Average calls*	*Number of counts*	*Average birds per count*	*Number of counts*	*Average birds per mile*
January			—	—	—	—
February	21	28.7	—	—	—	—
March	31	21.8	28	12.7	—	—
April	8	12.4	61	17.1	—	—
May	58	8.2	135	16.0	1	0.5
June	63	6.8	155	10.6	1	2.7
July	66	4.6	175	3.8	7	1.1
August	49	6.3	19	0.1	8	1.9
September	29	4.5	—	—	8	2.6
October	32	7.7	—	—	4	3,7
November	11	7.0	—	—	3	2.2
December	6	2.6	—	—	2	3.3
Totals	374	10.0	573	10.2	34	2.2

WILL DUNNE RANCH

Each week during 1941–43, except when weather prevented, wildlife populations on two sections were counted from horseback on the Will Dunne

Ranch in the northwest corner of Loup County in the midst of the Nebraska sandhills. Through it flows the Calamus River, bordered by extensive low hay meadows. One section included river bottomland and the ranch buildings and the other (adjoining) only upland sandhills. In six to eight hours of riding, most of the habitats along a 15-mile route through the two sections were examined. The average number of pheasants counted at each observation is given in Table 4. The pheasants

TABLE 4.—PHEASANTS ALONG 15-MILE ROUTE ON TWO SECTIONS OF LAND, DUNNE RANCH, 1941–43.

	3-year average	*Indicated birds per section*
January	83.0	41.5
February	60.2	30.1
March	57.5	28.7
April	19.5	9.7
May	6.1	3.1
June	7.2	3.6
July	24.0	12.0
August	35.7	17.8
September	37.7	18.8
October	80.8	40.4
November	85.0	42.5
December	93.3	46.6
Averages	44.4	22.2

tended to congregate along the river valley during the winter. At the approach of spring they migrated into the sandhills and established nesting territories near plum and chokecherry thickets. During the breeding season the actual numbers seen became fewer as the hens nested and cocks became more elusive. From July through September the numbers increased as young left the nests. And during late September the migration from the sandhills to the valleys began and the numbers again rose.

The year round average of birds per section was 22.2, but this figure does not indicate the actual or approximate numbers present because of the ebb and flow of birds from season to season. During March emigration was rapid and probably was completed before the end of April. In April the birds averaged about 10 per section. If this figure is assumed to be near the actual population, then the numbers seen in September, just before migration into the valleys, should indicate the success of nesting. For the three years, the latter was about double that for April which seems logical, since the population should double itself in order to be maintained from year to year. I am inclined to believe that 10 pheasants per section (1 square mile) at the beginning of the breeding season is the average number in this portion of Nebraska.

This method of observation showed any seasonal changes and also the population trend from year to year as accurately or more so than other methods. The average for 1941 was 19 per section; in 1942 this increased to 23.8, and in 1943 decreased to 22. A disadvantage in concentrating efforts on small areas lies in trying to apply information so obtained on a wide scale. Throughout Nebraska the pheasant population increased in 1942 over 1941 and decreased in 1943, as determined by statewide observations and by use of the other census methods here described. It is evident, then, that population changes in pheasants over wide areas may be reflected in data obtained on small tracts. Concentrated study in a small area yields more biological and ecological information concerning a species than the more extensive method.

SCAT COUNTS

On the meadows bordering North Marsh Lake in the Valentine National Wildlife Refuge, the numbers of pheasant droppings were counted on plots one yard square, at 20-pace intervals, and on strips six feet wide and up to 100 yards long. These tallies were made at intervals of one or two weeks. Where the meadows have been mowed there is a line of demarcation between the rank growth of the border of the sandhills and the more tender meadow grasses. Column 4 in Table 5 shows the average number of scats along such a border. Near the first willow thicket mentioned was another thicket and Column 5 gives the average number on areas of 1×6 feet, in a strip 6×150 feet. Another plot (Column 6) was in an abandoned field grown up to sunflowers and weeds; counts are for 1×6 foot areas in a strip 6×600 feet.

In an effort to correlate the number of droppings found in the wild with that of the birds present, seven captive pheasants were placed individually in mesh bottom cages over cardboard so that the number of scats dropped per hour could be counted; this was during March and April, 1944. The captives averaged about one dropping each 30 minutes during daylight hours. Their digestive activity was slightly greater in the late morning and late afternoon. While asleep defecative action was slowed and about one scat passed per hour. Individual roosts near willow thickets averaged 28 scats; assuming each was used but once, two scats per hour are indicated. The captives may not have fed as well as would birds in the wild, which would have decreased the number of pellets they dropped during the night. Use of pellet counts as a census method is of interest only during the day while the birds are active. The seven experimental birds showed that each dropped about 26 pellets during a 12-hour day, or one per 30 minutes; the averages, by hours were as follows:

TABLE 5.—AVERAGE PHEASANT SCAT COUNTS AT NORTH MARSH LAKE, VALENTINE NATIONAL WILDLIFE REFUGE, 1941–43.

	Around willow thicket, per square yard	*Pheasants flushed from willow thicket*	*Meadow between thickets, per square yard*	*Junction of meadow and unmowed pasture, per square yard*	*Edge of willow, per 6-foot strip*	*Abandoned field, per 6-foot strip*
January	1.27	15.2	.21	.27	6.3	1.45
February	1.26	15.0	.12	.00	5.2	.4
March	3.72	6.0	.40	.8	15.2	.9
April	1.79	6.2	.15	.66	3.2	.14
May	.36	1.4	.09	.5	.45	.1
June	.03	4.0	.00	.00	.00	.00
July	.04	1.7	.01	.06	.04	.06
August	.27	3.1	.04	.03	.16	.04
September	.27	10.1	.006	.06	.34	.11
October	.40	6.8	.024	.14	.37	.29
November	.47	2.5	.12	.07	2.3	2.0
December	1.30	7.0	.09	.13	7.9	1.34
Averages	.55	5.5	.105	.23	3.45	.57

	Number
9 A.M.	1.9
10	1.9
11	2.9
12	2.4
1 P.M.	2.6
2	2.0
3	2.1
4	1.9
5	2.1
6	3.1
7	1.4
8	2.2
8 P.M. to 8 A.M.	10.9
Total	36.1

Wild pheasants have definite habits of defecation which would influence the use of this method. The North Marsh habitat was overgrown with tall marsh grasses and sedges, bordered by willow thickets of varying depth and other willow thickets had grown up in low areas. The mowed meadows surrounded willow thickets, and tall grass of the sandhills bordered the meadows. The pheasants roosted within the marsh or willow thickets. In moving from the marsh to the sandhills where they fed during the day they followed definite routes of travel, making beaten paths through the thickets. Upon reaching the border of the willows a pheasant would hesitate, scan the meadow and horizon, then defecate before hurrying out upon the meadow (see Table 5, Columns 1 and 3). Similar action occurred by a bird walking from the sandhills toward a willow thicket when it reached the border of tall grass and mowed meadow. The numbers of scats found on this border was never as great, however, as along the willows. In the abandoned field, where no border study was made, dispersion of pheasant droppings indicated that they defecated at random while feeding among the weeds.

Seasonal changes in the numbers of scats present on the soil surface also are shown in Table 5. The quantities present depend on the number of birds using this habitat, and the durability of the scat, or its resistance to weathering. During the winter scats become frozen and remain intact much longer than in the summer when they are almost immediately attacked by insects or dissolve by heavy rains. The durability of the fecal pellet is also affected by the diet. Winter pellets may be black and of tarlike consistency from a diet of grass and seeds. The summer diet of insects and weed seeds results in a smaller pellet of different consistency.

All these factors affect the use of scat counts to determine relative pheasant populations. It is not possible simply to figure the average number of scats per acre calculated from square yard counts and assume that the result indicates the number of birds present. Thus, the year round average of scats per square yard, in all habitats, was 0.304, which would indicate 1471 scats per acre, and 56.6 birds using the acre daily or one bird for 56.6 days.

In the winter of 1938–39 the 200 acres of marsh and meadow along the west end of North Marsh Lake supported between 96 and 100 pheasants. In the winter of 1939–40 this increased to 200, and during 1940–41 to 300. In the winter of 1941–42 the population was placed at about 160 to 200, in 1942–43 from 130 to 150, and in 1943–44 at 80 and 100. These figures were determined by watching the meadows and marsh from high surrounding hills when the ground was covered with snow. The local winter concentration for the three-year period was about a bird to $1\frac{1}{2}$ acres.

At present, the use of scat counts to indicate pheasant numbers seems useful

during the winter months, when such counts will suggest the relative number of birds and any changes of population from year to year.

DISCUSSION

There is widespread interest in wildlife census methods and much study is being given to the subject in many states. Dalke (N. Amer. Wildl. Conf. Trans., 8: 380–384, 1943), Siegler and Coleman (Journ. Wildl. Mgt., 8: 93–99, 1944), Rasmussen and Doman (N. Amer. Wildl. Conf. Trans., 8: 369–379, 1943) and others have stressed the importance of determining wildlife populations by use of several methods for varying conditions throughout the year. The same is true in Nebraska. None of the methods here discussed has universal use for estimating the numbers of pheasants throughout the State under all conditions of habitat and in all months. Each is applicable to a certain set of conditions, and each has advantages over the other. The roadside count is best previous to the hunting season, if used repeatedly. The detonation method is applicable to breeding populations and for the pre-hunting tabulation. The one-minute crowing count gives best results early during the breeding season and is a fairly accurate indicator of relative population density. The scat count is of limited effectiveness, but should prove of value in areas of winter pheasant concentrations. Of the five methods under trial in Nebraska, the use of a horse and of concentrated study on a limited area, as at the Dunne ranch, has a year around effectiveness and appears to be applicable to wider usage. This is in agreement with the North Dakota pheasant studies reported by Roy N. Bach.